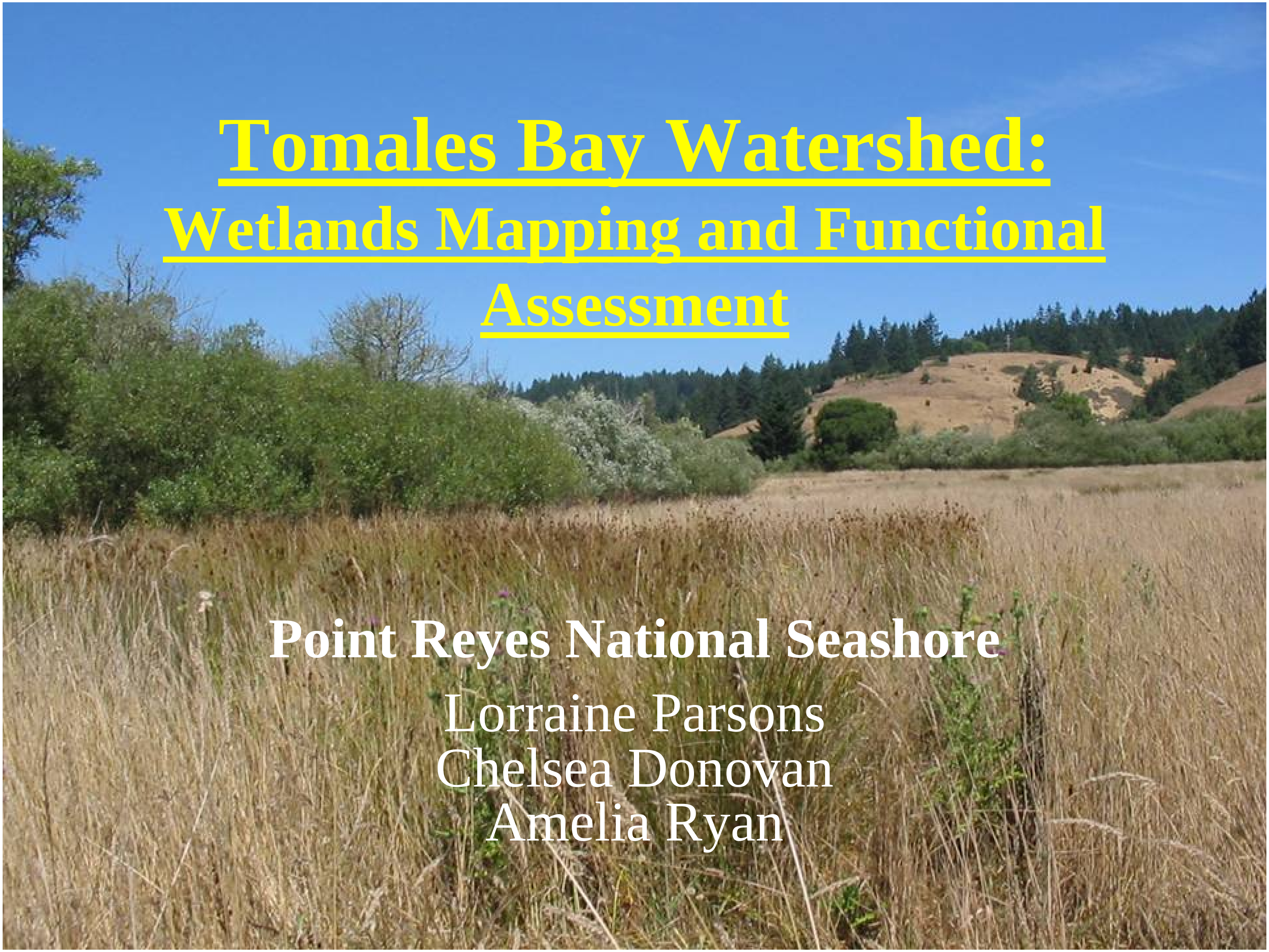
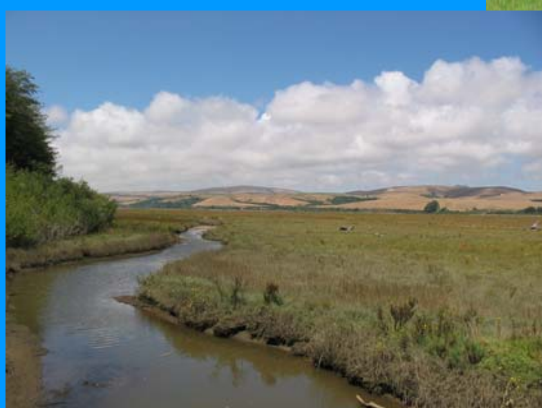


Tomales Bay Watershed:
Wetlands Mapping and Functional Assessment

Point Reyes National Seashore

Lorraine Parsons
Chelsea Donovan
Amelia Ryan

Wetlands Mapping at Point Reyes



Why Do We Map Wetlands?

- **NPS Policy**

  - **Inventory**: NPS directed to "conduct or obtain parkwide wetland inventories" to ensure proper management and protection of wetland resources" (NPS 2000, Section 4.6.5).
  - **Net Gain**: NPS mandated to implement the no net loss of wetlands policy and to "strive to achieve a longer term goal of net gain…" through restoration of previously degraded or destroyed wetlands" (NPS 2000, Section 4.6.5.).
  - **Restoration of Process and Function**: NPS required to develop "actions to reestablish environments in which wetland ecological processes can function as they did prior to disturbance…" (Director's Order #77-1, Section 5.5).
  - **Setting Wetland Goals**: NPS required to develop desired future conditions for wetland resources as part of GPRA.

Why Do We Map Wetlands?

- **Regulatory and Other Compliance**

  - Section 404 of the Clean Water Act
  - Section 401 of the Clean Water Act
  - Coastal Act
  - Floodplain Management Policy
  - Wetlands Management Policy

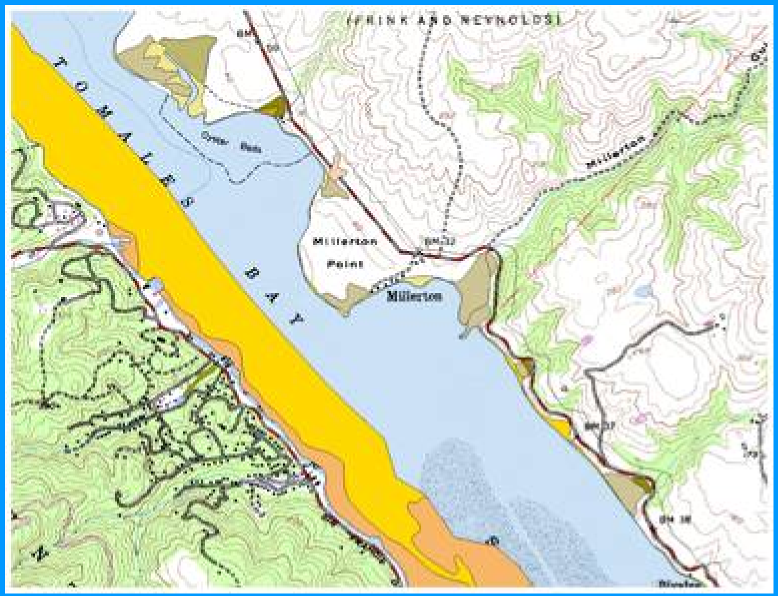
Wetlands Mapping at Point Reyes

- **Phase I: 2000**

Accuracy Assessment of Existing NWI Maps

Result?

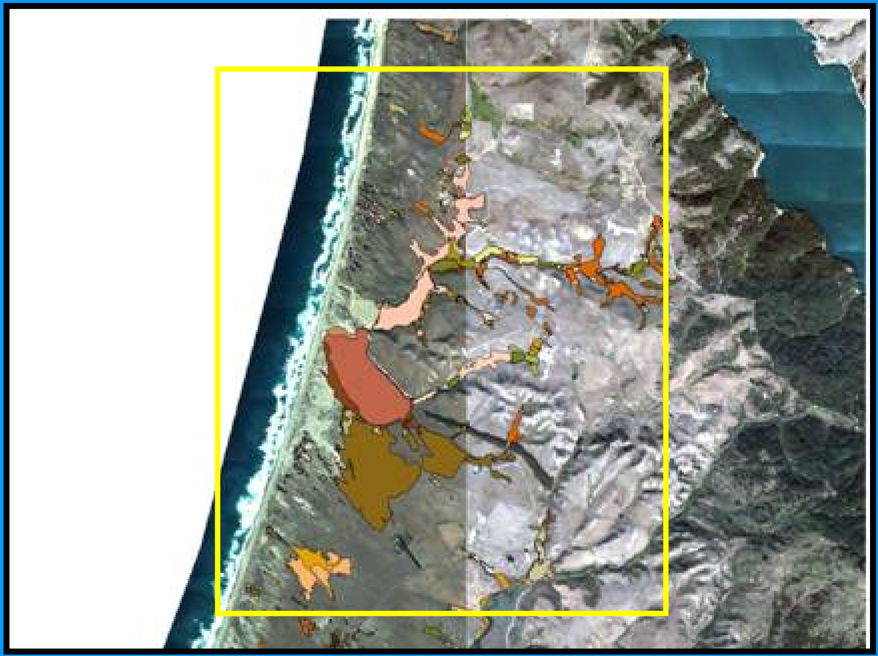
Missed more than 53 percent of the wetlands present



Wetlands Mapping at Point Reyes

- **Phase II: 2001-2002**

Intensive Mapping of Abbott's Lagoon



Wetlands Mapping at Point Reyes

- **Phase II: 2001-2002**

Initiated Intensive Mapping of Pastoral Zone

Result?

More than 911 acres of wetlands mapped

Wetlands Mapping at Point Reyes

- **Phase III: 2003-2004**

Mapping of Tomales Bay Watershed

- More "rapid"
  - Not collecting exhaustive plant list
  - Increasing the minimum mapping unit size
- Include a conditional and/or functional assessment component

Wetlands Mapping at Point Reyes

Why was Functional Assessment Considered Important?

Tomales Bay: Troubled Watershed

- Declared impaired under Section 303(d)
  - Sediment, nutrients, pathogens, mercury
- Problems in "Paradise"
  - Agricultural run-off
  - Leaking septic systems
  - Mercury mining
  - Leaking landfills
  - Oil spills

Wetlands Mapping at Point Reyes

Why was Functional Assessment Considered Important?

Tomales Bay: Troubled Watershed

- Who is affected?
  - Thriving mariculture industry
  - Marine and estuarine wildlife
  - Residents of and visitors to West Marin

Wetlands Mapping at Point Reyes

Why was Functional Assessment Considered Important?

Tomales Bay: Troubled Watershed

- What is being done about it?
  - **Source Reduction**
    - Riparian exclusion fencing
    - Agricultural infrastructure improvements
    - Septic systems repair
    - Rehabilitation of mercury mine

Wetlands Mapping at Point Reyes

Why was Functional Assessment Considered Important?

Tomales Bay: Troubled Watershed

- What is being done about it?
  - **Ecosystem restoration**
    - Native oysters
    - Wetlands

Wetlands Mapping at Point Reyes

Why was Functional Assessment Considered Important?

Tomales Bay: Troubled Watershed

- Why are wetlands important to restore (and preserve)?

Wetlands Mapping at Point Reyes

Hydrologic Process

Fluvial or Freshwater

Wetlands Mapping at Point Reyes

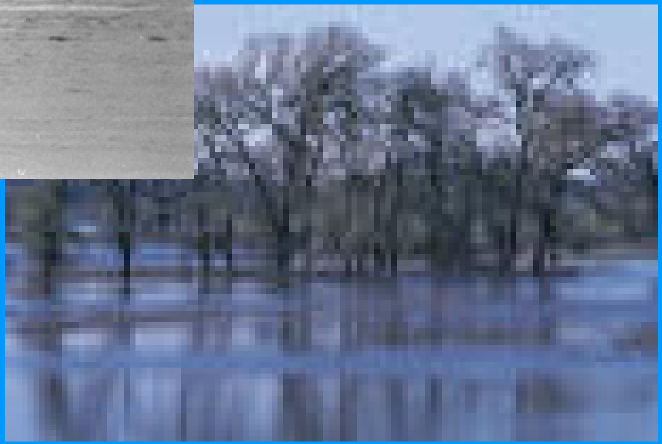
Hydrologic Process

Tidal

Wetlands Mapping at Point Reyes

Wetland Functions

Tidal Surge/Flood Attenuation (Energy Dissipation)



Wetlands Mapping at Point Reyes

Wetland Functions

Groundwater Recharge

Wetlands Mapping at Point Reyes

Wetland Functions

Carbon Production and Export

Wetlands Mapping at Point Reyes

Wetland Functions

Characteristic Plant Communities

Wetlands Mapping at Point Reyes

Wetland Functions

Wildlife Habitat and Support



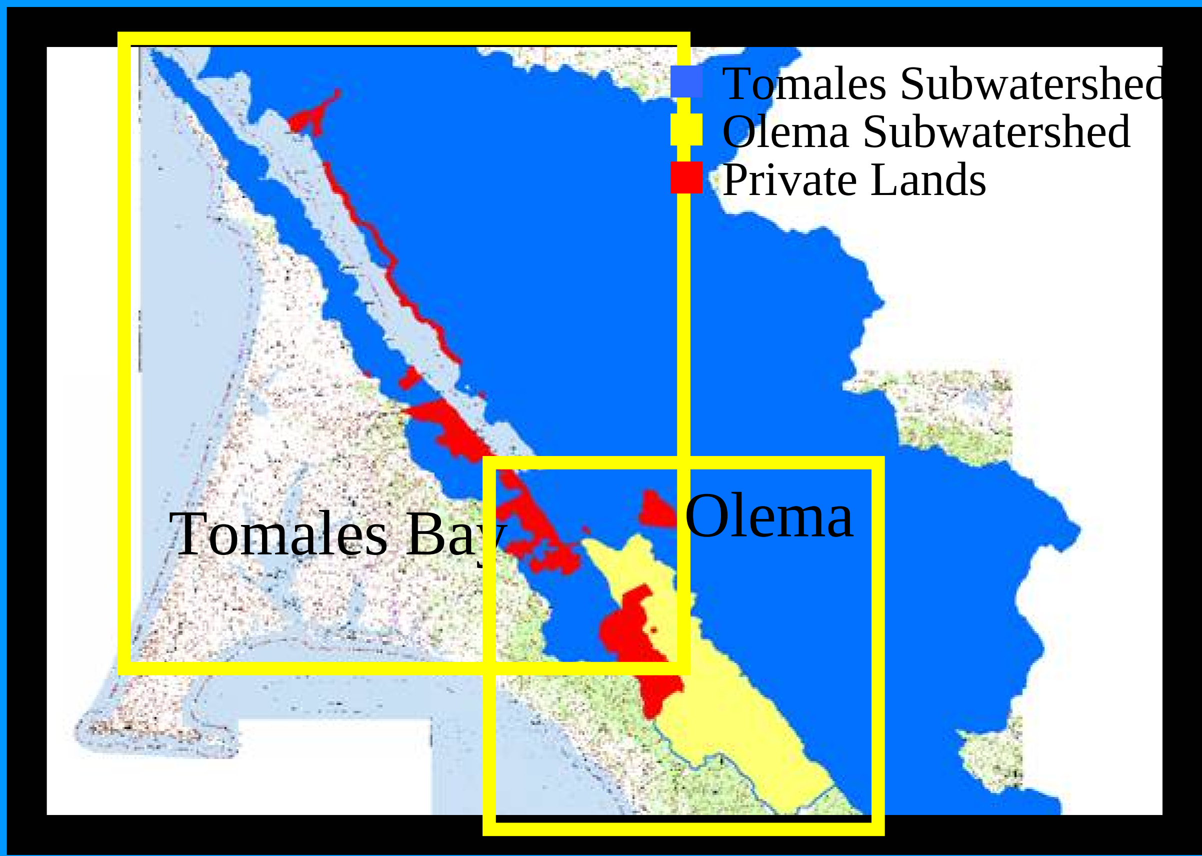

Wetlands Mapping at Point Reyes

Wetland Functions

Water Quality Improvement

Wetlands Mapping at Point Reyes

Tomales Bay Watershed Study Area



Wetlands Mapping at Point Reyes

Methodology: Wetlands Mapping Component

Step 1: Preliminary Assessment

- Organize Study Area into subwatersheds
- Office work
  - Topographic map
  - NWI map
  - Soil survey
  - Vegetation communities map

Subwatersheds

Wetlands Mapping at Point Reyes

Methodology: Wetlands Mapping Component

Step 2: Wetland Delineation

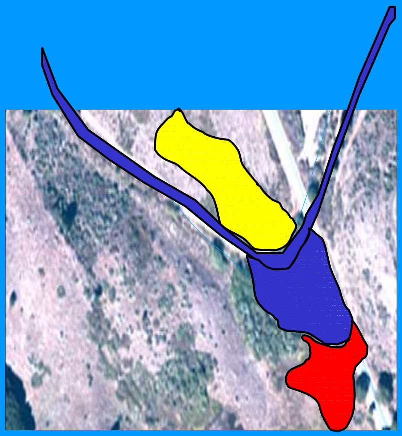
- Based on Cowardin definition: 1) hydrology and 2) vegetation or soils
- Use criteria from Corps' 1987 Manual to determine whether area meets two parameters.

Wetlands Mapping at Point Reyes

Methodology: Wetlands Mapping Component

Step 3: Wetland Classification

- Based on Cowardin classification system
- Use changes in 1) hydrologic regime modifier and/or 2) class to determine when to separate wetland polygons



Wetlands Mapping at Point Reyes

Methodology: Wetlands Mapping Component

Step 3: Wetland Classification

Emergent

Scrub
Shrub

Wetlands Mapping at Point Reyes

Methodology: Wetlands Mapping Component

Step 3: Wetland Classification

- Based on Cowardin classification system
- Use changes in 1) hydrologic regime modifier and/or 2) class to determine when to separate wetland polygons
- **Minimum mapping unit size is 0.1 acre, although varies depending on type.**

Wetlands Mapping at Point Reyes

Methodology: Functional Assessment Component

Step 4: Assessment of Condition and Functionality

First Step: What Do We Assess?

- Functions?
- Condition?
- Stressors?

Wetlands Mapping at Point Reyes

Methodology: Functional Assessment Component

Step 4: Assessment of Condition and Functionality

Background: Selection of Functional Assessment Methodology

- Numerous condition and functional assessment methodologies developed in last few decades:
  - Habitat Evaluation Procedure (HEP)
  - Wetland Evaluation Technique (WET)
  - Hydrogeomorphic Assessment Approach (HGM)
  - California Rapid Assessment Method (CRAM)

Wetlands Mapping at Point Reyes

Methodology: Functional Assessment Component

California Rapid Assessment Method

- Standard State Wide Methodology
- Identify ambient conditions of wetlands
- Rapid, scientifically defensible, and repeatable
- Quantify anthropogenic stress, management actions, and natural disturbance
- Quantify relationships between stress, function, and condition
- Cost effective

Wetlands Mapping at Point Reyes

Methodology: Functional Assessment Component

HGM + CRAM + Local Indices =

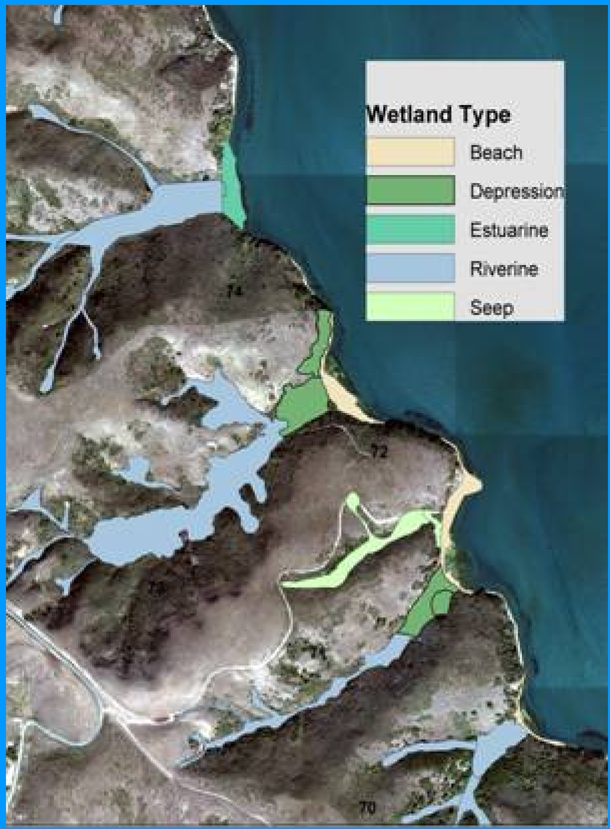
Point Reyes National Seashore
Wetland Functional Assessment

Wetlands Mapping at Point Reyes

Methodology: Functional Assessment Component

Step 4a: Hydrogeomorphic Classification

- Number of wetland classification systems
  - vegetation community
  - hydrologic (Cowardin)
  - HGM
- Adopted definition of wetland types from CRAM
- Loosely based on HGM Classification scheme



Wetland Classes at Point Reyes

RIVERINE Include channels that convey unidirectional, non-tidal, surface flow, and the active flood plain.

SEEPS, SLOPES and SPRINGS Form due to seasonal or perennial groundwater emergence into the root zone or across the wetland surface.

Wetlands Classes at Point Reyes

ESTUARINE
Subject to at least occasional tidal action. Waters are mixture of marine and non-saline.

DEPRESSIONAL
Exist in topographic lows or flats.

Wetlands Mapping at Point Reyes

Methodology: Functional Assessment Component

Steps 4b & 4c: Condition and Functional Assessment

- Stressor Indices
- Grazing Assessment
- Gully Assessment
- Channel Characteristics

→ **Wetland Condition**

- Hydrologic Process
- Hydrogeomorphic Functions
- Ecological Functions

→ **Wetland Functions**

Methodology: Functional Assessment Component

Steps 4b: Condition Assessment

Stressor Index

Hydrologic

- *Point source discharge*: Concentrated industrial, commercial, or residential (septic system) pollution discharge.
- *Nonpoint source discharge*: Urban runoff or agricultural drainage (includes cattle manure).
- *Flow diversion*: Includes culverts or arizona crossings. Any structure that impedes hydrology.
- *Flow impoundments* – Any unnatural barrier that is designed to contain water is a system.
- *Flow obstructions* – Any natural or unnatural object that obstructs the natural hydrology.

Methodology: Functional Assessment Component

Steps 4b: Condition Assessment

Stressor Index

Land Use

- *Resource extraction:* Removal of resources from urban, commercial and agricultural industries.
- *Agriculture:* Presence of grazing or crops.
- *High impact recreation* - Any aggressive recreation that immediately affects the wetland i.e. mountain biking, motorcross.
- *Low impact recreation* - Any low impact recreation that affects the wetland i.e. hiking
- *Transportation* – Any motorized transportation that immediately affects the wetland.

Methodology: Functional Assessment Component

Steps 4b: Condition Assessment

Stressor Index

Biotic Structure

- *Direct discharges from greywater or septic tanks*: Discharge of anthropogenic fluid from residential wastes (sewage or wash water).
- *Mowing, grazing, excessive herbivory* – of vegetation in wetland.
- *Removal of woody debris* – Evidence of the removal of woody debris in the wetland.
- *Evidence of fire* - Upper layer of soil consists of ash.
- *Human visitation* – Wetland is accessible and visited by humans.
- *Invasive or non-native plant species* – The presence of invasive or non-native plant species.
- *Feral animals* - Formerly domesticated animals that are in a wild

Methodology: Functional Assessment Component

Steps 4b: Condition Assessment

Stressor Index

Rating:

- *No Stressor (0),*
- *Stressor of Low Magnitude (1),*
- *Stressor of Moderate Magnitude (2),*
- *Stressor of Large Magnitude (3),*
- *and Unknown.*

Methodology: Functional Assessment Component

Step 4c-1: Functional Assessment - Processes and Functions

Hydrologic and ecological processes and functions performed by different wetland classes.					
	Estuarine	**Riverine**	**Depressional**	**Seep/Spring**	**Lacustrine**
Hydrologic Process – Fluvial and/or Freshwater	♦	♦	♦	♦	♦
Hydrologic Process – Tidal	♦				
Tidal Surge/Flood Attenuation	♦	♦			
Groundwater Recharge		♦	♦		♦
Water Quality Improvement	♦	♦	♦	♦	♦
Carbon Export	♦	♦	♦	♦	♦
Plant Community	♦	♦	♦	♦	♦
Wildlife Habitat	♦	♦	♦	♦	♦

Methodology: Functional Assessment Component

Step 4c-1: Functional Assessment - Processes and Functions

Hydrological Process	Freshwater Surface Flows
	Tidal Surface Flows
Ecological Function	Tidal Surge/ Flood Attenuation
	Water Quality
	Carbon Production and
	Groundwater Recharge
	Plant Community
	Wildlife - Aquatic
	Wildlife - Terrestrial Component

Methodology: Functional Assessment Component

Step 4c-2: Functional Assessment Metrics

Tidal Surge/ Flood Attenuation	Entrenchment Ratio (based on Rosgen)
	Flood Land Connection (adapted from CRAM)
	Distance (adapted from HGM)
	Topographic Complexity (adapted from CRAM)
	Vertical Biotic Structure (adapted from CRAM)
	Soil Substrate Condition (adapted from CRAM)

Methodology: Functional Assessment Component

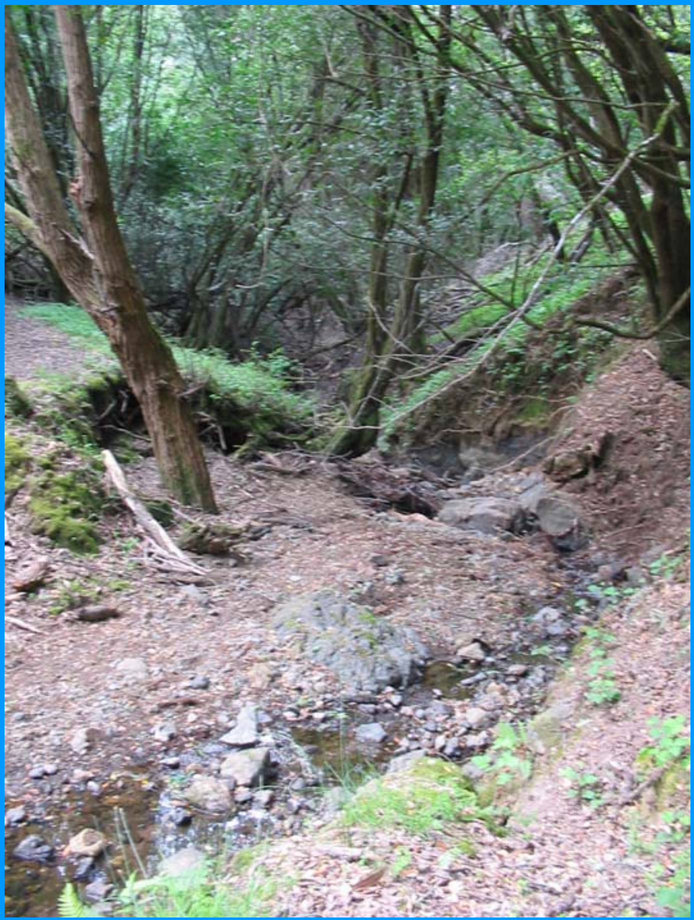
Step 4c-2: Functional Assessment Metrics

Indicator or Metric	**Method Source**	**Hydrologic Process – Fluvial/FW**	**Hydrologic Process - Tidal**	**Tidal Surge/ Flood Atten-uation**	**Groundwater Recharge**	**WQ Improvement**	**Carbon Production/ Export**	**Plant Community**	**Wildlife Habitat/Support**
Entrenchment Ratio	Rosgen	♦		♦		♦		♦	
Sinuousity	Rosgen	♦	♦						
Flood Land Connection	CRAM	♦	♦	♦		♦		♦	
Hydroperiod	CRAM	♦	♦						
Water Source	CRAM	♦	♦						
Number and Degree of Manmade Constrictions	HGM	♦	♦						

Tidal Surge/Flood Attenuation

Entrenchment Ratio

(Class=Lower Riverine)



Why important?

- *Relates to ability of waters to exceed channel banks during storm events*

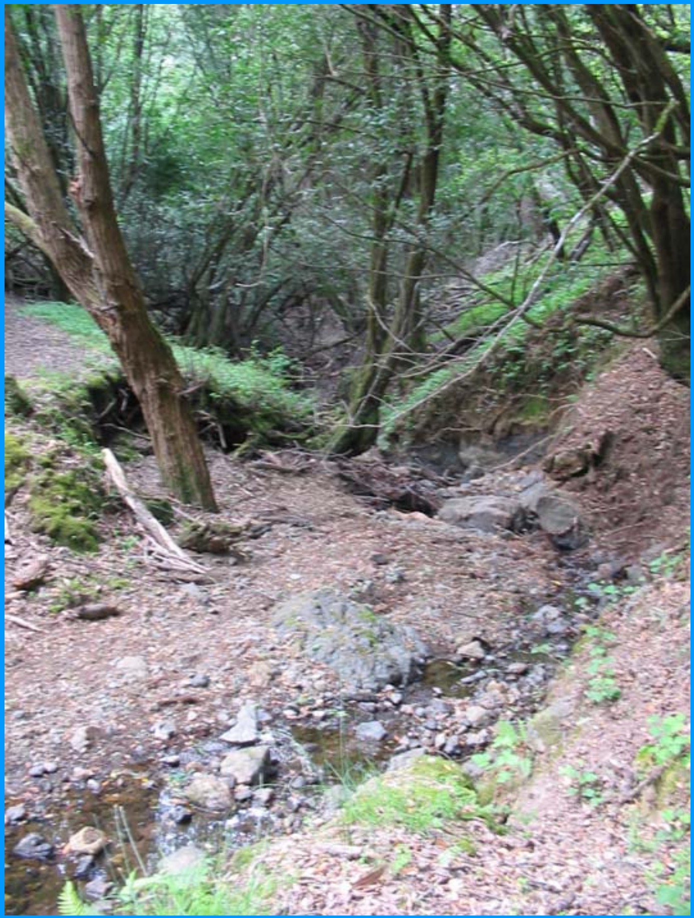
Adapted from Rosgen

Tidal Surge/Flood Attenuation

Entrenchment Ratio
(Class=Lower Riverine)

Where assessed?

- *Field*



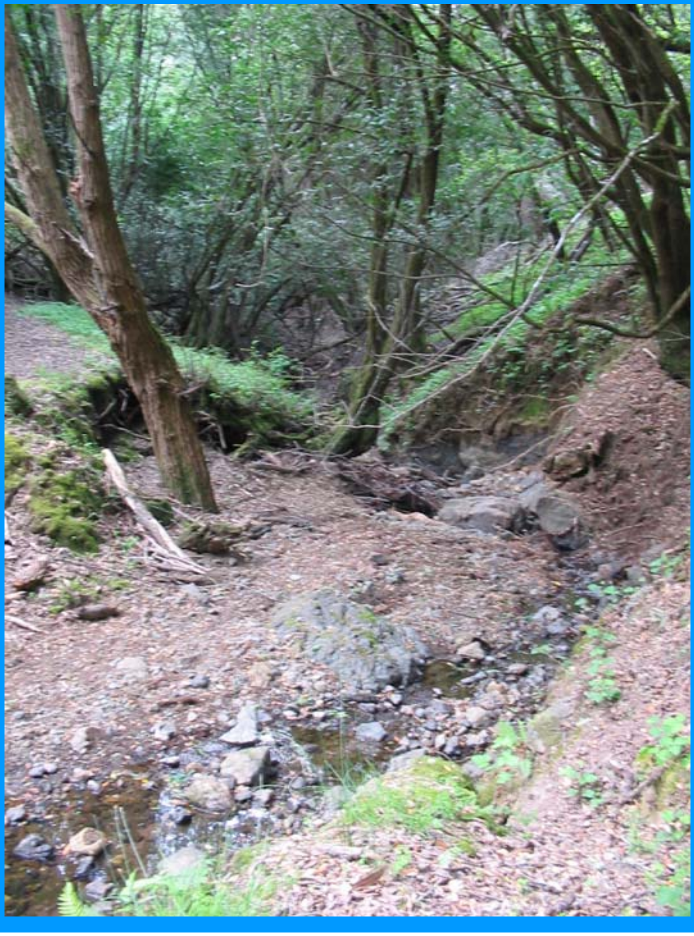
Adapted from Rosgen

Tidal Surge/Flood Attenuation

Entrenchment Ratio
(Class=Lower Riverine)

How assessed/calculated?

$$\frac{\textit{bank width}}{\textit{bank height}}$$



Adapted from Rosgen

Tidal Surge/Flood Attenuation

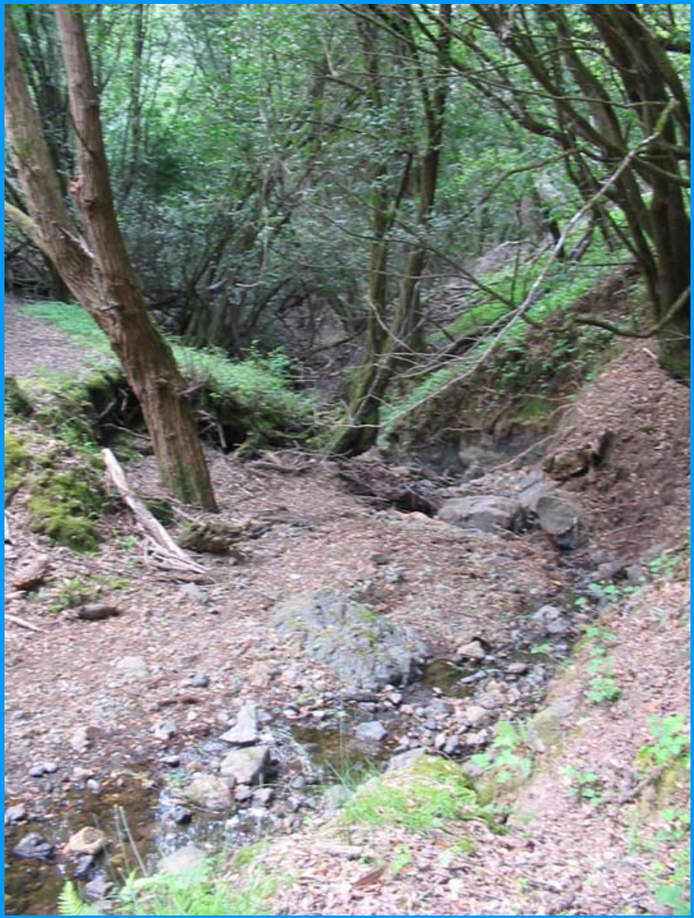
Entrenchment Ratio

(Class=Lower Riverine)

How rated?

Code	Rating
4	Ratio is greater than (>) 2.2
3	Ratio is between 1.4 and 2.2
2	Ratio is less than (<) 1.4.

Rating is based on surveys of reference creeks with slopes < 0.02 (Rosgen 1996)



Adapted from Rosgen

Tidal Surge/Flood Attenuation

Flood-Land Connection

(Riverine & Estuarine)

Why important?

- *Relates to ability of waters to reach floodplains during annual to moderate storm events*

Adapted from CRAM

Tidal Surge/Flood Attenuation

Flood-Land Connection

(Riverine & Estuarine)

Where assessed?

- *Office*
- *Field*

Adapted from CRAM

Tidal Surge/Flood Attenuation

Flood-Land Connection
(Riverine & Estuarine)

How assessed/calculated?

Qualitative assessment of access of waters to floodplains during annual to moderate storm events

Adapted from CRAM

Tidal Surge/Flood Attenuation

Flood-Land Connection

(Riverine & Estuarine)

How rated?

Code	Rating
4	Rising water in the AA has unrestricted access to adjacent upland, without levees, excessively high banks, walls, or other obstructions to the lateral movement of flood flows
3	Lateral excursion of rising waters in the AA is partially restricted by unnatural features, such as levees or excessively high banks. Restrictions may be intermittent along the AA, or the restrictions may occur only along one bank or shore. Flood flows may exceed the obstructions, but drainage back to the wetland is incomplete due to impoundment.
2	All water stages in the AA are contained within artificial banks, levees, sea walls, or comparable features. There is essentially no hydrologic connection to adjacent uplands

Rating is based on surveys of reference wetlands or judgment as to best functioning condition?

Adapted from CRAM

Tidal Surge/Flood Attenuation

Distance
(Riverine & Estuarine)

Why important?

- *Increased distance between upland edge and channel represents greater potential reduction in wave energy.*

Adapted from HGM

Tidal Surge/Flood Attenuation

Distance
(Riverine & Estuarine)

Where assessed?

- *Office*

Adapted from HGM

Tidal Surge/Flood Attenuation

Distance
(Riverine & Estuarine)

How assessed/calculated?

Repeated measurements of distance from channel to upland edge throughout the Assessment Area

Adapted from HGM

Tidal Surge/Flood Attenuation

Distance
(Riverine & Estuarine)

How rated?

Code	Rating
4	Realized floodplain width is 76 – 100% of potential floodplain width.
3	Realized floodplain width is 50 – 75% of potential floodplain width.
2	Realized floodplain width is 25 – 49% of potential floodplain width.
1	Realized floodplain width is 0 – 24% of potential floodplain width.

Rating is based on attainment of potential.

- Different rating system than HGM

Adapted from HGM

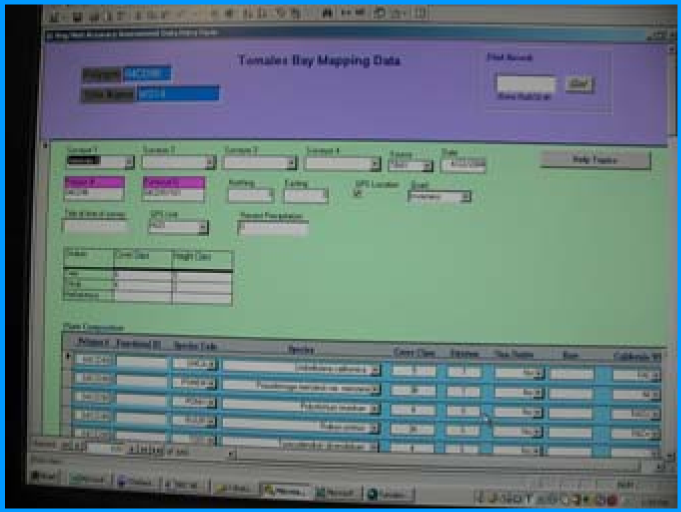
Methodology: Data Analysis

- Analysis of Stressor and Functional Data
  - Stressor indicators summed - Stressor Total
  - Respective functions summed within each wetland class to provide Functional Total
  - Weighting of metrics and indicators not included
  - Some metrics not included in preliminary analysis because not rated
- Statistical Analysis
  - Statistical summaries
  - ANOVA on subwatershed comparison
  - Cluster Analysis on Stressor and Functional Totals within each wetland class

Methodology: Data Collection

PDA - Electronic Datasheets

- Zire 21 Palm Pilot
- Pen Dragon software compatible with MS Access
- PORE/GOGA Plant List



Methodology: Cost and Implementation

- Cost
  - 1 GS-5 and 1 GS-7
  - WRD provided ~ $50,000
- Implementation
  - 13 months
  - Conducted throughout year regardless of season, although strategized work approach

Results/Discussion: Wetlands Mapping

Wetland Type	Tomales Bay Acres	Tomales Bay Percentage	Olema Valley Acres	Olema Valley Percentage
Riverine	262	25	350	71
Seep/Spring	57	5.5	35	7
Depressional	388	37.5	110	22
Estuarine	328	31.5	0	0
Total	1035	100	495	100

Results/Discussion: Subwatershed Comparison

Functional Score Totals

Tomales Bay	**Functionality**			
	Estuarine	Depressional	Riverine	Seep
Average	81.89	68.54	96.24	39.55
Median	84.0	70.75	98.5	40.0
Standard Dev	9.40	9.91	9.77	3.89
Minimum	55.0	44.5	59.1	28.0
Maximum	95.0	90.0	110.0	45.0
95% CI-Upper	86.9	72.54	98.8	41.32
95% CI-Lower	76.88	64.54	93.65	37.78
Sample Size	16	26	65	21

Olema	**Functionality**			
	Estuarine	Depressional	Riverine	Seep
Average	ND	61.74	95.11	39.04
Median	ND	61.5	94.75	39.25
Standard Dev	ND	8.81	8.57	4.07
Minimum	ND	43	61	32.5
Maximum	ND	79	111	49.0
95% CI-Upper	ND	64.19	97.25	40.13
95% CI-Lower	ND	59.29	93.00	37.95
Sample Size	ND	52	64	56

Results/Discussion: Subwatershed Comparison

Stressor Score Totals

Tomales Bay	**Stressors**			
	Estuarine	Depressional	Riverine	Seep
Average	11.16	12.89	10.0	11.81
Median	10.5	10.0	8.50	11.0
Standard Dev	7.12	11.30	7.10	9.26
Minimum	2.0	1	0	0
Maximum	29.5	53.0	35.5	34.5
95% CI-Upper	14.95	17.45	11.76	16.03
95% CI-Lower	7.37	8.32	8.24	7.59
Sample Size	16	25	65	21

Olema	**Stressors**			
	Estuarine	Depressional	Riverine	Seep
Average	ND	17.71	19.44	16.89
Median	ND	18.5	20.75	18.5
Standard Dev	ND	7.12	6.76	7.75
Minimum	ND	0	0	3.0
Maximum	ND	32.5	36	32.5
95% CI-Upper	ND	19.69	21.13	18.97
95% CI-Lower	ND	15.73	17.75	14.82
Sample Size	ND	52	64	56

Results/Discussion: Condition Assessment

Wetlands with the Highest Stressor Scores

List of functional units with highest stressor scores in Tomales Bay watershed.

No.	Wetland Type	Identification Name	Stressor Total	Description
1.	Depressional	Giacomini	53.0	East Pasture of Giacomini Ranch and lower portion of Tomasini Creek subwatershed that is grazed by dairy cattle.
2.	Seep	Ledum	39.0	Above Ledum Swamp
3.	Riverine	WS 11 & 12	36.0	West side of Olema Valley near Five Brooks that is at least partially grazed by horses.
4.	Depressional	Giacomini	36.0	West Pasture of Giacomini Ranch and lower portion of Fish Hatchery Creek subwatershed that is grazed by dairy cattle.
5.	Riverine	Giacomini	35.50	Diked portion of Lagunitas Creek near Waldo Giacomini Ranch.
6.	Seep	WS 58	34.50	Headwater source for riverine wetland near L Ranch that is grazed by dairy cattle.
7.	Depressional	Bear Valley	32.50	Pasture grazed by beef cattle near Seashoe’s Bear Valley headquarters
8.	Seep	WS 02	32.50	Southeastern portion of Olema Valley
9.	Seep	WS 05	30.50	Southeastern portion of Olema Valley
10.	Depressional	WS 71	30.00	Drainage to Tomales Beach near Kehoe Ranch that is grazed by dairy cattle.
11.	Riverine	WS 30	30.00	Small drainage to Olema Marsh on west side of Inverness Ridge

National Park Service
Point Reyes National Seashore

Results/Discussion: Condition Assessment

Biotic Stressors in Tomales Bay


Tule Elk


Cows


Mule Deer

Herbivory and Non-Point Source Discharge


Italian Thistle

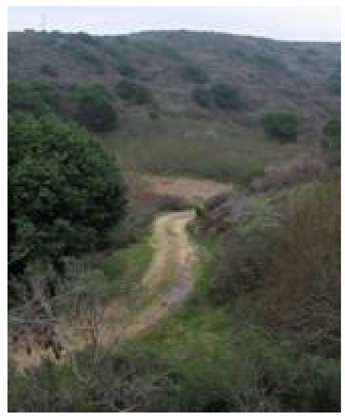

Velvet Grass

Non-native Vegetation

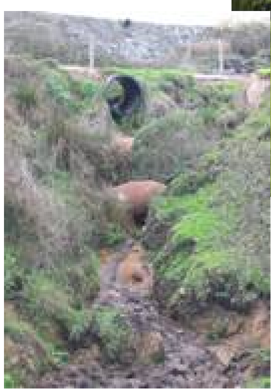
Results/Discussion: Condition Assessment

Abiotic Stressors in Tomales Bay

Stock Ponds



Roads



Culverts

Compaction and Gullying

Ranching

Roads and Trails

Homes

Urbanization

National Park Service
Point Reyes National Seashore

Results/Discussion: Condition Assessment

How does Tomales Bay compare?

California Wetlands

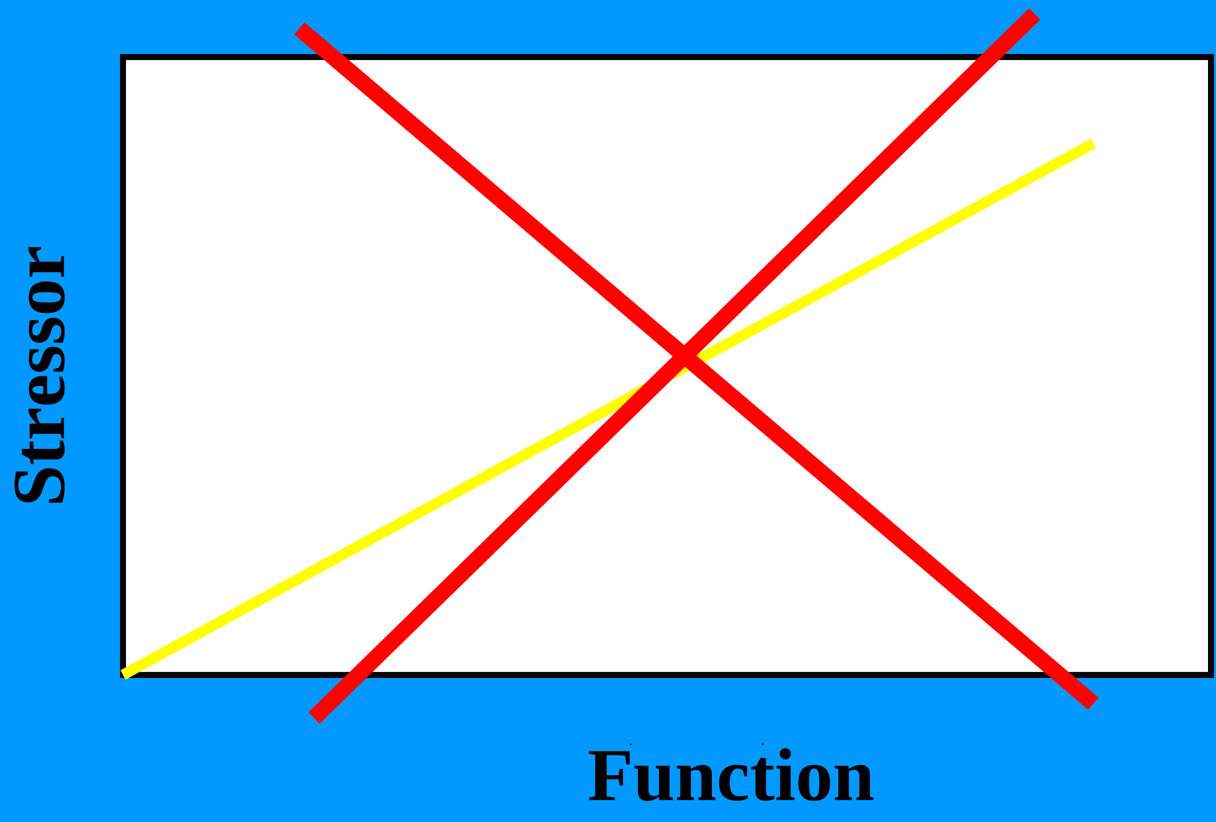
Excellent

Poor

Tomales Bay Wetlands

Results/Discussion: Functional/Stressor Analysis

Relationship between Stressors and Function

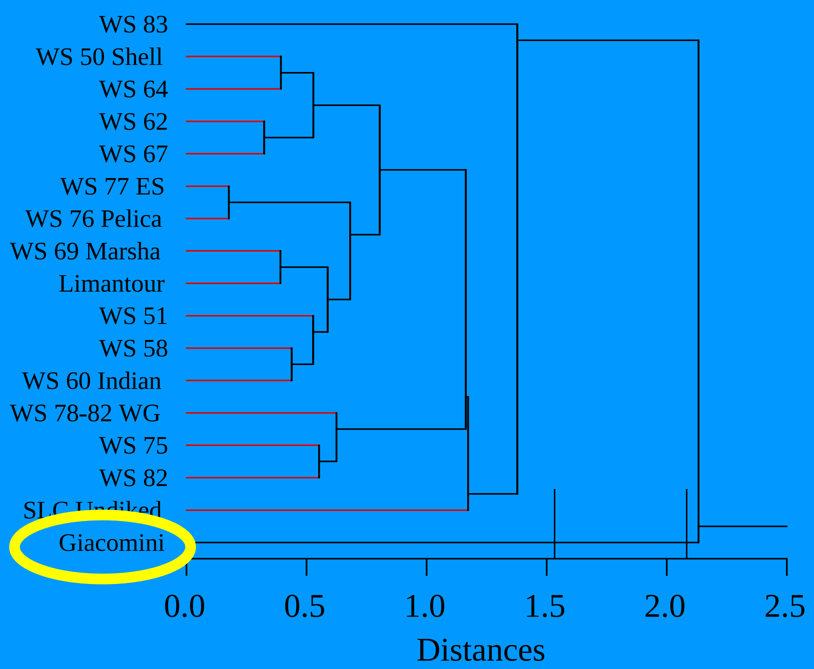


Results/Discussion: Functional/Stressor Analysis

Estuarine Wetlands

Functional Totals

Cluster Tree



Results/Discussion: Functional/Stressor Analysis

Preliminary Recommendations for Restoration and Source Reduction

- **Tier 1:** Sites with low to moderate functional scores and high stressor scores
  - Sites where relationship between functional and stressors appear strongest
  - Better sense of what relevant stressors in these sites might be
- **Tier 2:** Sites with moderate functional scores and stressor scores
- **Tier 3:** Areas that appeared anomalous in terms of scoring
  - Use to modify assessment methodology if needed

Results/Discussion: Functional/Stressor Analysis

Tier 1: High Priority Areas

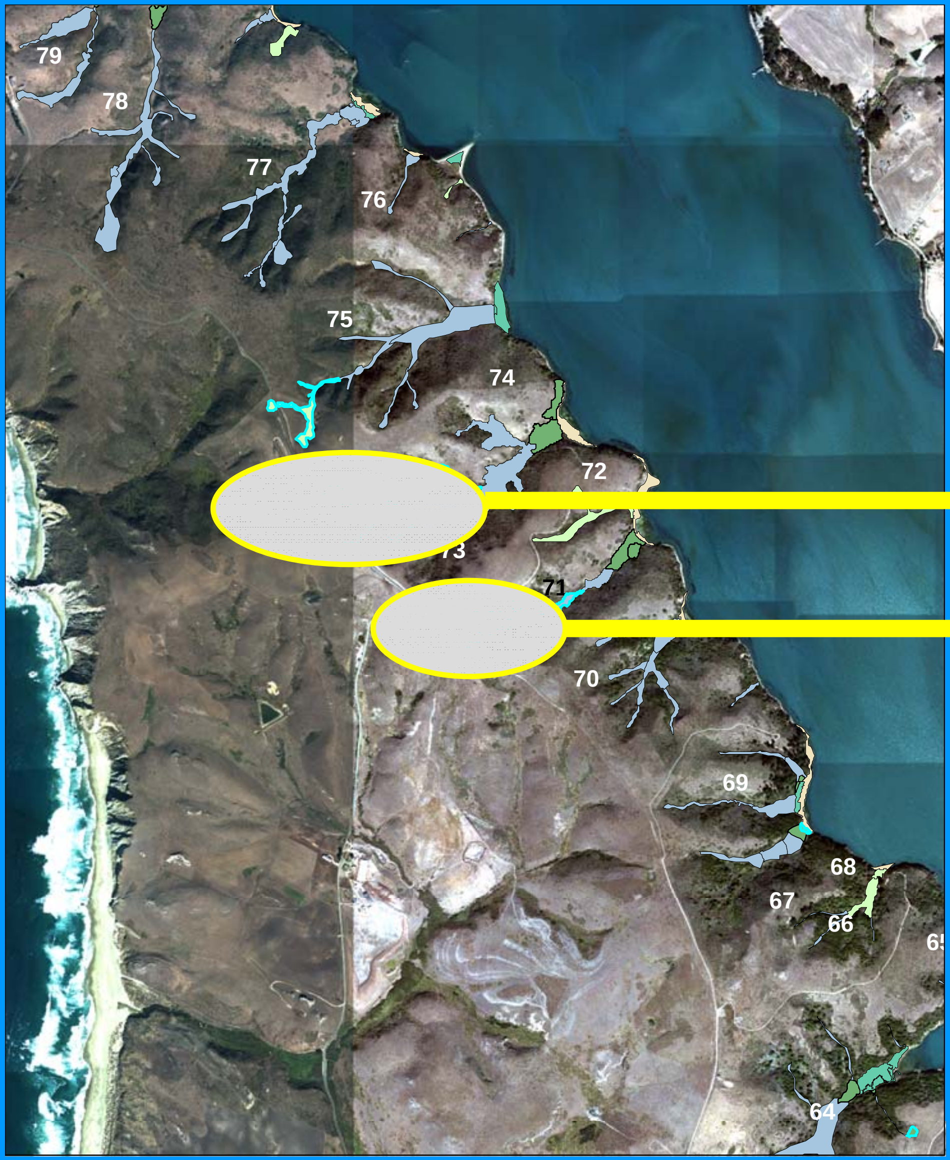
Tier I: High priority sites or Functional Units for further evaluation and potential restoration efforts.					
	Functional Unit/Site	Ownership	Wetland Class	Stressor Score	Functional Score
	Waldo Giacomini Ranch East Pasture and Tomasini Creek subwatershed	NPS Under ROU	Depressional	53.0	46.0 (43.0-90.0)
	Waldo Giacomini Ranch Diked portion of Lagunitas Creek near Waldo Giacomini Ranch	State Lands Commission	Riverine	35.5	59.1 (59.1-111)
	Watershed 58 Headwater source for drainage to Indian Beach near L Ranch	NPS	Seep	34.5	28.0 (28.0-49.0)
	Waldo Giacomini Ranch Diked estuarine portions in northern portion of ranch	NPS Portion under ROU	Estuarine	29.5	55.0 (55.0-95.0)
	Watershed 71 Upper portion of drainage to Tomales Beach near Kehoe Ranch	NPS	Riverine	30.0	71.0 (59.1-111)
	Watershed 29 Bear Valley near Visitor Center	NPS	Riverine	27.0	61.0 (59.1-111)

Results/Discussion: Functional/Stressor Analysis

Tier 2: Moderate Priority Areas

Tier II: Medium priority sites or Functional Units for further evaluation and potential restoration efforts.

	Functional Unit/Site	Ownership	Wetland Class	Stressor Score	Functional Score
	Vedanta Unit Depressional area at Vedanta Ranch	private	Depressio nal	28.0	43.0 (43.0-90.0)
	Fault Sag Pond Pond along fault in Olema Valley	NPS?	Depressio nal	27.0	45.0 (43.0-90.0)
	Watershed 24 Northeastern portion of Olema Valley	?????	Riverine	25.5	76.5 (59.1-111)
	Watershed 12 Wetland near Five Brooks in Olema Valley	NPS	Depressio nal	25.5	48.0 (43.0-90.0)
	Watershed 73 Drainage north of Tomales Beach near Kehoe Ranch	NPS	Riverine	24.0	76.0 (59.1-111)
	Watershed 25 Wetland in northeastern portion of Olema Valley	????	Depressio nal	22.0	44.0 (43.0-90.0)
	Watershed 25 Upper portion of watershed in northeastern portion of Olema Valley	NPS	Seep	21.50	32.50 (28.0-49.0)
	Watershed 56 Drainage to Heart's Desire State Park	California State Parks	Riverine	20.0	75.5 (59.1-111)
	Watershed 29 Bear Valley near Visitor Center	NPS	Seep	19.50	32.50 (28.0-49.0)
	Watershed 24 Wetland in the northeastern portion of Olema Valley	????	Depressio nal	18.0	45.0 (43.0-90.0)

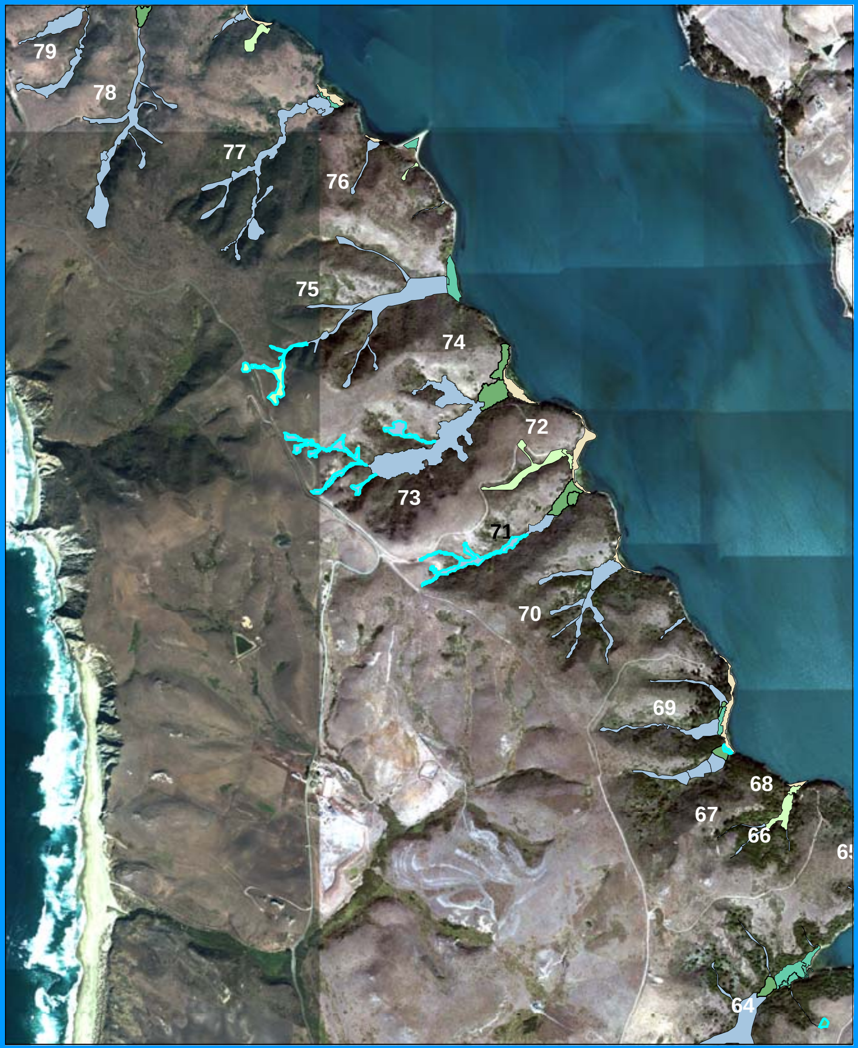


Results/Discussion: Functional/Stressor Analysis

Tier 1

Tier 2

Conclusions:



- **Valuable Tool**: Condition and Functional Assessment appears promising as a tool to increase value of mapping efforts in conserving, protecting, managing, and ultimately restoring wetlands.

Conclusions:

- **Still in its Infancy:** Format, analysis, and use of this information still in its infancy, both nationally and at PORE.
  - Add new indicators if necessary
  - Refine existing indicators
  - Refine rating scales
  - Possibly add weighting system
  - Reconsider value and/or structure of Stressor Indices
  - Track progress of CRAM team in refining preliminary assessment versions

Conclusions:

- Next Steps: **Next steps for PORE**:
  - Refine preliminary analysis of Tomales Bay
  - Potential use in evaluating pre- and post-restoration conditions and functionality at PORE restoration sites.
  - Use to guide development of desired future conditions at PORE
  - Potential use at other PWR parks?

Horseshoe Pond Restoration Project, PORE

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